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Effect of some herbicides on the growth and sporulation of two fungal biocontrol agents

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Effect of some commonly used herbicides viz., Alachlor 50% w/w, Butachlor 50% w/w, Pendemethalin 50% w/w and Glyphosate 50% w/w on the growth and sporulation of *Trichoderma* and *Gliocladium* spp. was studied. The results revealed a significant variation in the effect of these chemicals on the radial growth in terms of per cent reduction in growth of the antagonists. It was further observed that all the herbicides were more or less compatible with the antagonists up to certain concentrations with glyphosate showing more promising effect.

Key words : Compatibility, herbicides, *Trichoderma, Gliocladium*

INTRODUCTION

In the present agricultural scenario, biocontrol agents are being widely used for integrated disease management. Several scientists have shown that integration of chemicals with biocontrol agents have given promising results (Papavizas, 1985). This method not only controls the diseases but also minimizes the hazards caused by the chemicals to the environment along with the reduction in the cost of the chemicals used. Among the biocontrol agents, *Trichoderma* and *Gliocladium* have gained importance during the last few years due to their ability to control a number of virulent and destructive plant pathogens. The volatile and non-volatile compounds produced by species of *Trichoderma* and *Gliocladium* inhibit the growth of wide range of fungi viz., species of *Fusarium, Rhizoctonia, Pythium, Phytophthora, Sclerotium* and *Sclerotinia* (Mishra, 1996).

Many of the biocontrol agents are found to be compatible with chemicals. A classical example is the control of *Armillaria mellea* with a combination of methyl bromide and *Trichoderma* (Ohr *et al.*, 1973). But *Trichoderma harzianum, T. viride* and *Chaetomium globosum* were found to be sensitive to benomyl (Kay and Stewart, 1994). Biocontrol agents alone have slow effect on the target pathogens but when combined with chemicals result in better control. So emphasis has been given more on combined effect rather than single.

A biocontrol agent may be sensitive or insensitive to a certain range of chemicals. In order to select suitable chemical compounds which are compatible with the biocontrol agents, evaluation of the sensitivity of biocontrol agents to chemicals becomes necessary.

The present investigations have been carried out to check the compatibility of some commonly used herbicides namely Alachlor 50% w/w, Butachlor 50% w/w Pendeme-thalin 50% w/w and Glyphosate 50% w/w with some species of fungal biocontrol agents viz., *Trichoderma harzianum, T. viride, Gliocladium virens* and *G. roseum.*

MATERIALS AND METHODS

The wild isolates of *T. harzianum, T. viride, G. virens* and *G. roseum* were collected from the DBT sponsored ad-hoc research project of the laboratory of Plant Pathology Department at Bidhan Chandra Krishi Viswavidyalaya. The antagonists were subcultured on PDA slants by single spore isolation.

Wherever needed the Potato Dextrose Agar medium (with 2% each of dextrose and agar) was used for culturing the organisms and assay of the test herbicides. The herbicides selected for evaluation were Alachlor 50% w/w, Butachlor 50% w/w, Pendemethalin 50% w/w and Glyphosate 50% w/w with concentrations 25, 50, 100, 200 and 500 ppm. The herbicidal solutions were prepared in sterilized distilled water on the basis of ai of the respective herbicides. Biological parameters such as radial mycellial growth, % inhibition of sporulation and % inhibition in spore germination of the biocontrol agents by these herbicides were studied by adopting Poison Food Technique and Spore Germination Technique (Nene and Thapliyal, 1993).

RESULTS AND DISCUSSION

The investigations revealed a significant variation in the effect among different chemicals on the radial growth, % inhibition of sporulation and % inhibition of spore germination. *T. harzianum* (Table 1) could grow well in butachlor and glyphosate even at the highest concentration tested (500 ppm) and in alachlor and pendemethalin upto 200 ppm. Per cent reduction in spore germination was least in glyphosate with only 35.1% at 500 ppm. These results agree with the findings of Parakhia and Akbari (2001). All the herbicides reduced the sporulation remarkably except glyphosate and that is up to 50 ppm of the herbicides. The results of the present investigation agree with the earlier work of Jayaraj and Radhakrishnan (2000).

T. viride could grow well in all the herbicides tested except alachlor in which the growth was trace at 500 ppm (19.9 mm). Per cent inhibition in spore germination was least in glyphosate (35.1 in 500 ppm) as like *T. harzianum*. *T. viride* could sporulate well in glyphosate up to 200 ppm while other herbicides greatly reduced the sporulation (Table 1). This goes with the findings of Parakhia and Akbari (2001) that glyphosate had no effect on *T. viride*.

Both *G. virens* and *G. roseum* could grow well in glyphosate (70.4 mm, 73.5 mm at 500 ppm) but alachlor markedly reduced the mycelial growth even at the lowest concentration tested (58.8 mm, 56.8 mm at 25 ppm). Pendemethalin (500 ppm) also greatly reduced the mycelial growth in both the spe-

Table 1 : Effect of some herbicides on mycelial growth, sporulation and spore germination of two species of *Trichoderma*

Treatments	Concentration in ppm	Mean radial mycelial growth (mm)*		% of sporulation inhibition*		% of spore germination inhibition*	
		T. harzianum	*T. viride*	*T. harzianum*	*T. viride*	*T. harzianum*	*T. viride*
Alachlor 50% w/w	25	79.5	86.6	33.3	22.43	54.1	22.5
	50	77.7	83.8	56.9	48.97	56.2	55.76
	100	55.7	77.3	72.5	61.28	65.0	58.6
	200	32.6	64.5	84.3	79.6	68.6	63.03
	500	17.3	19.9	100.0	97.9	75.95	82.5
Butachlor 50% w/w	25	87.9	87.3	42.0	34.1	64.1	39.9
	50	86.4	84.8	46.0	47.7	69.83	38.26
	100	85.7	81.0	60.0	59.10	73.23	57.97
	200	84.8	74.8	66.0	77.30	76.43	62.87
	500	70.8	62.3	90.0	95.4	80.0	72.2
Pendemethalin 50% w/w	25	90.0	90.0	45.8	30.6	23.4	27.01
	50	90.0	87.0	58.3	36.7	30.15	31.6
	100	87.7	86.5	70.8	48.96	31.5	32.6
	200	57.3	84.2	89.6	69.4	33.5	33.9
	500	23.2	36.5	97.9	85.7	37.9	37.3
Glyphosate 50% w/w	25	90.0	90.0	8.3	0.00	14.5	17.4
	50	87.7	90.0	14.6	18.3	22.2	17.9
	100	84.9	90.0	41.7	36.7	23.5	26.8
	200	67.8	83.3	58.3	55.1	28.03	28.6
	500	49.4	79.8	66.7	65.2	35.1	33.6
	Control	90.0	90.0	0	0	10.70	12.03
S.Em±		0.7	0.5	2.9	2.6	2.5	2.4
C.D. at 5%		1.9	1.4	8.2	7.5	7.2	6.7

* Mean of 3 replications

Table 2 : Effect of some herbicides on mycelial growth, sporulation and spore germination of two species of *Gliocladium*

Treatments	Concentration in ppm	Radial mycelial growth (mm)*		% of sporulation inhibition*		% of spore germination inhibition*	
		G. virens	*G. roseum*	*G. virens*	*G. roseum*	*G. virens*	*G. roseum*
Alachlor 50% w/w	25	58.8	56.8	13.22	22.02	57.8	57.7
	50	54.3	54.6	30.18	36.01	68.5	67.1
	100	50.7	52.7	37.74	62.01	78.3	74.6
	200	22.4	28.8	43.41	78.00	82.6	76.9
	500	15.1	17.3	81.14	100	84.6	86.1
Butachlor 50% w/w	25	90.0	90.0	19.16	37.25	48.6	47.5
	50	85.1	86.0	29.80	47.05	52.1	51.4
	100	80.7	73.6	53.20	62.74	54.6	56.2
	200	59.9	66.4	57.46	72.54	67.5	62.7
	500	39.6	48.2	71.18	100	76.7	71.8
Pendemethalin 50% w/w	25	88.0	87.5	6.40	18.73	17.8	20.1
	50	86.4	86.0	34.06	26.55	20.3	26.8
	100	82.7	85.0	55.33	32.80	63.5	32.9
	200	51.8	55.0	70.22	42.17	69.8	45.03
	500	18.1	23.4	85.11	60.93	72.8	72.8
Glyphosate 50% w/w	25	84.2	80.0	14.98	22.43	0.0	1.9
	50	77.5	80.0	22.48	30.59	0.0	2.4
	100	76.3	79.5	34.98	34.68	0.0	4.45
	200	74.3	76.0	49.98	53.05	6.6	7.4
	500	70.4	73.5	59.98	65.29	9.3	9.3
	Control	90.0	90.0	0	0	0	0
S.Em±		0.9	0.9	2.6	2.0	2.4	3.4
C.D. at 5%		2.7	2.8	7.5	5.8	6.9	9.6

*Mean of 3 replications

cies. Glyphosate had only marginal effect on the sporulation of both the species of *Gliocladium* compared to that of other herbicides screened. Spore germination was also best in glyphosate even at 500 ppm (% inhibition in 9.3 at 500 ppm for both the species). However, the present observations do not corroborate with the earlier observation of Wachowska (1998).

The results of the present investigations clearly explored that all the herbicides included in these experiments are more or less compatible with the antagonists up to a certain concentration. However, glyphosate would be the best select so far as compatibility of these herbicides in particular with that of both *Trichoderma* and *Gliocladium* spp. is concerned.

REFERENCES

Papavizas, G.C. 1985. *Trichoderma* and *Gliocladium :* Biology, Ecology and Potential for Biocontrol. *Ann Rev Phytopatho* **23** : 23-54.

Mishra, P.K. 1996. *Biological control of Fusarium corm rot and yellows of gladiolus.* Thesis, M.Sc. Ag. G.B. Pant Univ. of Agriculture and Technology, Pantnagar, India.

Ohr, H.D, Munnecke, D.E. and Bricker, J.L. 1973. The interaction of *Armillaria mellea* and *Trichoderma* spp as modified by methyl bromide. *Phytopathology,* **63** : 965-973.

Kay, S.J. and Stewart, A. 1994. The effect of fungicides on fungal antagonists of onion white rot and selection of dicarboximide–resistant biotypes. *Plant Pathology,* **43** (5) : 863-871.

Nene, Y.L. and Thapliyal, P.N. 1993. Evaluation of Fungicides. (*in*) *Fungicides in Plant Disease Control,* pp. 525-542. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi ; Bombay ; Calcutta.

Parakhia, A.M. and Akbari, L.F. 2001. Effect of weedicides on fungal bioagents. *Jour Mycol and Plant Pathol* **31**(1) : 106.

Jayaraj, J. and Radhakrishnan, N.V. 2000. Survival of the biocontrol agent *T. harzianum* in soil as influenced by certain herbicides. *Ind Jour Weed Sci,* **32** (1-2) : 116-117.

Wachowska, U. 1998. Effect of glyphosate on the growth and sporulation of several fungi species grown *in vitro. Acta Mycologica,* **33**(1) : 155-160.

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